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What is claimed is:

- 1 1. A light emitting apparatus, comprising:
2 a semiconductor light emitting element that emits light
3 with a predetermined wavelength;
4 a light-transmitting portion that includes a recess to
5 house the semiconductor light emitting element, the
6 light-transmitting portion being of a light-transmitting
7 material and the recess being formed by molding the
8 light-transmitting material; and
9 a phosphor layer portion that is thinly formed along the
10 surface of the recess, the phosphor portion including a phosphor
11 to be excited by irradiating light emitted from the
12 semiconductor light emitting element.
- 1 2. The light emitting apparatus according to claim 1,
2 wherein:
3 the light-transmitting portion has a light convergence
4 shape to converge light emitted from the light emitting element.
- 1 3. The light emitting apparatus according to claim 1,
2 wherein:
3 the semiconductor light emitting element is a flip-chip
4 type LED element that emits light from its light emission
5 surface located on the opposite side of its mounting surface.
- 1 4. The light emitting apparatus according to claim 1,
2 wherein:
3 the recess is located close to the semiconductor light

4 emitting element along the profile of the semiconductor light
5 emitting element.

1 5. The light emitting apparatus according to claim 1,
2 wherein:

3 the semiconductor light emitting element is composed of
4 a plurality of LED elements disposed in a predetermined
5 arrangement.

1 6. The light emitting apparatus according to claim 1,
2 wherein:

3 the semiconductor light emitting element is composed of
4 a plurality of LED elements with different emission wavelengths
5 disposed in a predetermined arrangement.

1 7. A method of making a light emitting apparatus,
2 comprising the steps of:

3 preparing a light-transmitting portion that includes a
4 recess to house a semiconductor light emitting element, the
5 light-transmitting portion being of a light-transmitting
6 material and the recess being formed by molding the
7 light-transmitting material, the recess being provided with a
8 phosphor layer that is thinly formed along the surface of the
9 recess;

10 forming an electrode of metal material;

11 mounting the semiconductor light emitting element on the
12 electrode;

13 positioning the light-transmitting portion to the
14 electrode; and

15 bonding the light-transmitting portion onto the
16 electrode such that the phosphor layer of the recess surrounds
17 the semiconductor light emitting element.

1 8. The method according to claim 7, wherein:
2 the phosphor layer is formed by spraying a phosphor
3 material on the surface of the recess after forming the recess
4 by molding.

1 9. The method according to claim 7, wherein:
2 the electrode is a lead electrode provided on the surface
3 of a submount member of high thermal conductivity.

1 10. The method according to claim 7, wherein:
2 the electrode is a copper-foil electrode provided through
3 an insulation layer on the surface of a base member of high
4 thermal conductivity.

1 11. The method according to claim 7, wherein:
2 the semiconductor light emitting element is flip-chip
3 bonded onto the electrode.

1 12. A light emitting apparatus, comprising:
2 a light emitting element;
3 a power supply portion to supply electric power to the
4 light emitting element;
5 a first optical system that is formed in a range of a
6 predetermined angle to the center axis of the light emitting
7 element when determining the center of emission surface of the

8 light emitting element as origin point; and

9 a second optical system that includes a reflection plane
10 disposed facing the emission surface of the light emitting
11 element and a radiation face to externally radiate light being
12 emitted from the light emitting element and then reflected on
13 the reflection plane;

14 wherein the first optical system and the second optical
15 system are disposed such that light being emitted from the light
16 emitting element is externally radiated in the direction
17 vertical to the center axis of the light emitting element.

1 13. The light emitting apparatus according to claim 12,
2 wherein:

3 the predetermined angle is greater than 40 degrees.

1 14. The light emitting apparatus according to claim 12,
2 wherein:

3 the first optical system and the second optical system
4 optically control nearly all amount of light being emitted from
5 the light emitting element to be externally radiated.

1 15. The light emitting apparatus according to claim 12,
2 wherein:

3 the first optical system and the second optical system
4 are of a material with a refractive index of about 1.5, and an
5 incident angle of light to enter to the first optical system
6 from the light emitting element and an incident angle of light
7 reflected on the reflection plane to enter the radiation face
8 from the light emitting element are 35 degrees or less.

1 16. The light emitting apparatus according to claim 12.

2 wherein:

3 the second optical system includes: an upper circular
4 reflection plane that is formed such that part of a parabola
5 symmetrical to an axis vertical to the center axis and having
6 the center of emission surface of the light emitting element
7 as its focal point is rotated 360 degrees around the center axis;
8 and a side radiation face that radiates light subjected to total
9 reflection by the upper reflection plane in the lateral
10 direction.

1 17. The light emitting apparatus according to claim 12,

2 wherein:

3 the second optical system allows part of light emitted
4 from the light emitting element to be externally radiated as
5 nearly parallel light in the direction vertical to the center
6 axis of the light emitting element.

1 18. The light emitting apparatus according to claim 12,

2 wherein:

3 the first optical system includes a recess to house the
4 light emitting element, the recess being located close to the
5 semiconductor light emitting element along the profile of the
6 semiconductor light emitting element.

1 19. The light emitting apparatus according to claim 12,

2 wherein:

3 the light emitting element is composed of a plurality of

4 light emitting elements disposed in a predetermined
5 arrangement.

1 20. The light emitting apparatus according to claim 12,
2 wherein:

3 the light emitting element is composed of a plurality of
4 light emitting elements with different emission wavelengths
5 disposed in a predetermined arrangement.

1 21. A method of making a light emitting apparatus,
2 comprising the steps of:

3 forming a power supply portion;

4 mounting a light emitting element on the power supply
5 portion;

6 positioning an optical system to the power supply portion,
7 the optical system being composed of a first optical system that
8 includes a recess to house the light emitting element and a
9 convergence surface to converge light emitted from the light
10 emitting element and then radiate it in the direction vertical
11 to the center axis of the light emitting element, and a second
12 optical system that includes a reflection plane to allow the
13 total reflection of light emitted from the light emitting
14 element and then radiate it in the direction vertical to the
15 center axis of the light emitting element; and

16 bonding the optical system onto the power supply portion
17 such that the light emitting element is surrounded by the
18 recess.

1 22. The method according to claim 21, wherein:

2 the first optical system includes a phosphor layer that
3 is thinly formed by spraying a phosphor material on the surface
4 of the recess after forming the recess by molding.

1 23. The method according to claim 21, wherein:
2 the bonding step is conducted after injecting transparent
3 sealing resin into the recess.

1 24. A light emitting apparatus, comprising:
2 a light emitting element;
3 a power supply portion to supply electric power to the
4 light emitting element; and
5 an optical system that includes a recess to house the light
6 emitting element, a light-guiding portion to guide light
7 emitted from the light emitting element in the direction
8 vertical to the center axis of the light emitting element, and
9 a reflection portion to reflect light being guided through the
10 light-guiding portion in the direction vertical to the center
11 axis and then radiate it in the direction parallel to the center
12 axis.

1 25. The light emitting apparatus according to claim 24,
2 wherein:

3 the optical system includes an overlying reflection
4 portion by which light emitted from the light emitting element
5 in the direction nearly over the light emitting element is
6 reflected in the direction vertical to the center axis.

ABSTRACT OF THE DISCLOSURE